Intro to Proteins I

**I. Chemical Bonds**

A. Covalent

1. Stronger bond, unaffected by water

B. Ionic

1. Weaker bond, weakened by water

C. Hydrogen

1. Weak bond caused by dipole-dipole interactions, strongest IM bond

D. Van der Waals

1. Hydrophobic interactions

2. Generally occur on the inside of proteins away from water

**II. Water**

A. Polar molecule with + and – dipoles

1. Allows for interactions with polar and charged particles

B. Highly cohesive due to H-bonding

1. Excellent solvent for other H-bonding molecules

C. Forms hydrated shells around polar molecules and rapidly fluctuates H-bond structure

1. Allows high concentrations of polar molecules to coexist in aqueous solution

D. Dissociation

1. [Pure H2O] = 55.5M

2. [OH-] = [H3O+] = 1x10-7M

E. Hydrophobic Effect

1. Nonpolar molecules spontaneously aggregate together in water

2. Increases the entropy of water molecules as less are locked up in hydration cage

a. Increasing the entropy of water releases free energy

F. Amphiphilic

1. Water can act as an acid or base

**III. Buffers**

A. Weak acids and bases produce strong conjugate bases/acids

1. Weak acids/bases are good buffers

B. Definition of pH

1. pH = -log[H+]

2. Ka = [H+][A-]/[HA] [H+] is constant when buffer is strong

C. pKa

1. The point at which a molecule has its highest buffering capacity

2. At this point, [HA] = [A-]

2. pKa = -logKa

D. Henderson-Hasselbalch

pH = pKa + log [A-]/[HA]

E. Properties of Buffers

1. A good buffer for the human body is at pH ~ 7.4

F. Respiratory Acidosis

1. Due to hypoventilation, not enough CO2 leaving the blood via exhalation

a. Accumulation of CO2

2. Results in an increase in [H+]

G. Respiratory Alkalosis

1. Due to hyperventilation, too much CO2 leaving the blood via exhalation

a. Drop in CO2 levels

2. Results in a decrease of [H+]

H+ + HCO3- **<->** H2CO3 **<->** H2O + CO2

H. Physiological Equilibriumis achieved by:

1. Renal elimination (H+)

2. Chemical buffering within the body

a. HCO3/CO2 system, CO2 comes from metabolism of carbohydrates

3. Pulmonary elimination (pCO2)